



“Fueling the Car of Tomorrow” University of Detroit Mercy DAPCEP class March 2007

In March of 2007, twenty students from the Detroit Area Pre-College Engineering Program (DAPCEP) participated in a five week Saturday course entitled *Fueling the Car of Tomorrow*. The course was developed and taught by Professor Mark Schumack of the University's Mechanical Engineering Dept.

Experts predict that worldwide oil production will peak sometime within the next few years. With the specter of diminishing gasoline supplies looming on the horizon, engineers are designing alternate ways to power automobiles. Through hands-on activities, students in 9th through 12th grades learned about the fundamentals of propulsion systems, fuel origination and production, performance characteristics of alternative fuels, technological issues, and sustainability of the alternatives. The pros and cons of ethanol, biodiesel, hydrogen, and electricity as automotive energy sources were highlighted in this five-session class.

Week One – Fundamentals of Internal Combustion Engines

Students calculated the fuel economy, in units of miles per gallon (mpg), for several different car speeds using empirical formulas. After calculating the power required to propel a car for various speeds, students took data from an engine test stand to estimate actual fuel economy.



Week Two – Making Biodiesel

Students produced biodiesel from soybean oil and alcohol, using lye as a catalyst. The students' samples were then gathered and poured into the fuel tank of a diesel vehicle.

Week Three – Testing Biodiesel Properties and Measuring the Energy Content of Fuels

Students measured the viscosity and density of biodiesel, and compared their data to published results. Using a simple “homemade” calorimeter, students determined the energy content of ethanol and methanol.

Week Four – Building a Fuel Cell Car

From a commercially available fuel cell car kit, students assembled a model car run by solar cells, used solar cells to produce hydrogen from electrolysis, and ran a car powered by a hydrogen fuel cell.



Week Five – Which Fuel is Best?

The group project involved a comparison of the amount of fuel consumed, the fuel cost, the fuel economy (mpg), the amount of raw material used, and the CO₂ produced for a vehicle traveling from Detroit to Seattle using each of the following fuels: gasoline, ethanol, biodiesel, electricity, and hydrogen. Students prepared PowerPoint slides and made presentations describing their results to parents at the final session.

Evaluation:

Students were asked to respond to the following questions on a five-point scale – 1 being strongly disagree and 5 being strongly agree. The mean response is listed.

1	The scientific/math concepts I learned in this course help me better understand the world of science.	4.5
2	I feel that this class met my expectations of learning as described in the 'Course Description' brochure.	4.5
3	This is a class I would recommend to a friend because of the enjoyment and learning I experienced.	4.4
4	This course helped me visualize myself in a science/engineering related career.	4.1
5	This experience in this class will help in my questioning, thinking, and problem solving, and my ability to work in groups as I return to my regular school science class.	4.3
6	My instructor presented quality material, provided a positive learning experience and related to my learning needs.	4.6
7	My overall rating of this class is very high.	4.6